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INDEPENDENT EVALUATION PLAN FOR THE CHEMICAL ATTACK WARNING TRA--ETC(U)
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DEPARTMENT OF THE ARMY
US ARMY ORDNANCE AND CHEMICAL CENTER AND SCHOOL
ABERDEEN PROVING GROUND, MARYLAND 21005

MAJ Law/prm/
584-3392

ATSL-CLC-O

28 NOV 1979

SUBJECT: Independent Evaluation Plan for the Chemical Attack Warning Transmission System (CAWTS)

LEVEL II

SEE DISTRIBUTION

1. Reference:

a. Army Regulation 71-3, Force Development User Testing, 8 Mar 77.

b. TRADOC Regulation 71-9, Force Development User Testing and Evaluation, 1 Oct 78.

2. In accordance with above references, the Independent Evaluation Plan (IEP) for the Chemical Attack Warning Transmission System is provided.

3. Point of contact at this headquarters is MAJ Law, AUTOVON 584-3392/ 3823.

FOR THE COMMANDER:

1 Incl
as

WALTON A. PHILLIPS
Colonel, CmlC
Director, Chemical Directorate

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SUBJECT: Independent Evaluation Plan for the Chemical Attack Warning Transmission System (CAWTS)

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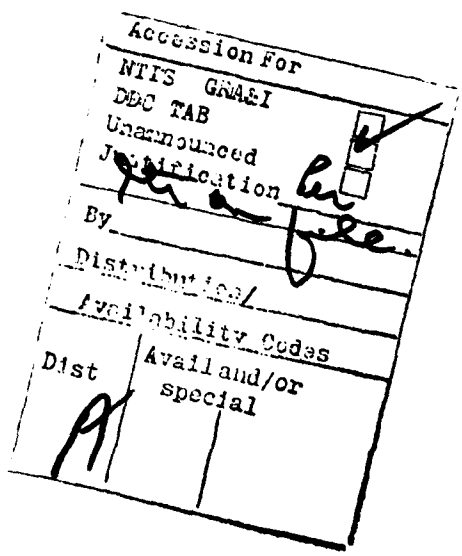

INDEPENDENT EVALUATION PLAN

FOR

CHEMICAL ATTACK WARNING TRANSMISSION

SYSTEM (CAWTS)

NOVEMBER 1979

PREPARED BY MAJOR LAMONT W. LAW

1.0 SYSTEM DESCRIPTION

1.1 Name of System: Chemical Attack Warning Transmission System (CAWTS).

1.2 Background: The current warning system for a chemical attack relies on radio, hand and arm signals, and noise makers in accordance with unit SOP's. The current system requires one to two minutes to warn troops in a company-size area. The introduction of CAWTS will not only provide a standard warning device, but it will reduce the warning time to 30 seconds for company-size units. This has been proven to significantly reduce casualties.

1.3 Characteristics and Configuration: The CAWTS is a modified M158/159 ground signal that will fire a capsule containing both audible and visual signals into the air. At approximately 500 feet the capsule ejects a whistle that will function for approximately five seconds and a star cluster containing two white and one red stars. The cartridge is held in one hand with the muzzle pointing upward, the safety pin is pulled, and the base of the cartridge is struck in an upward motion with the other hand causing the cartridge to fire.

1.4 Concept of Employment: The CAWTS will be issued to cellular teams and to platoon and company/battery/troop-size units. The recommended basic load is eight rounds for company/battery/troop and four for each cellular team. The CAWTS will be initiated in response to detection of a chemical agent attack (chemical agent alarm, unusual odor, onset of symptoms, detector paper, detector kits, etc). It will not be fired in response to a CAWTS fired by an adjacent unit, nor under conditions requiring automatic masking procedures (page 5-3, FM 21-40). The audible signal will warn personnel whose vision is preoccupied by their tasks or whose line-of-sight access to the warning flare is blocked. The visual signal will warn personnel working in areas with high background noise.

1.5 Test Manager: MAJ Lamont W. Law, US Army Ordnance and Chemical Center and School (USAOCCS), ATTN: ATSL-CLC-O, Aberdeen Proving Ground, MD 21005, AUTOVON 584-3392/3823.

2.0 ISSUES AND ASSOCIATED CRITERIA

2.1 Mission Performance

*2.1.1 Issue: Can the cartridge be safely hand-launched by an individual wearing full chemical protective ensemble and protective mask?

2.1.1.1 Scope: Testing will be conducted during daylight and night operations by typically trained troops equipped with full chemical protective equipment under simulated combat conditions.

*Critical issues

2.1.1.2 Criterion: The CAWTS cartridge will be capable of being safely launched by typically trained troops while wearing full chemical protective ensemble within three seconds after the functioning of the M8 Alarm.

2.1.1.3 Rationale: The letter requirement states that the CAWTS is expected to reduce the warning time for company/battery/troop size unit to 30 seconds. This breaks out to three seconds to function the CAWTS, seven seconds for CAWTS to reach its maximum intensity, five seconds for sound to travel to all unit personnel, and 15 seconds for personnel to mask and put on their hoods.

2.1.1.4 Source: Letter Requirement (LR) for the Chemical Attack Warning Transmission System (CAWTS), approved 8 Jan 79.

*2.1.2 Issue: Does the CAWTS fulfill its warning function?

2.1.2.1 Scope: Testing will be conducted during daylight and darkness under simulated battlefield conditions expected in central Europe, e.g., smoke, fog, haze, cloud cover, noise, etc., utilizing mechanized infantry troops. Troops will be engaged in activities similar to those of actual combat. During testing, other illuminating devices (star clusters of various types and colors and flares) will be utilized to determine if troops can distinguish CAWTS. Tests will be conducted utilizing the current alarm system (metal on metal, voice and electronic communications) to compare CAWTS with the current system.

2.1.2.2 Criterion:

a. The maximum audible and visual signal must occur within seven seconds after the CAWTS is fired.

b. Under daylight conditions, the audible and visual warning radius must extend to 500 meters (minimum acceptable, 1500 desirable).

c. When compared to the current warning system, the CAWTS will cause a two fold increase (minimum acceptable, 95 percent of personnel desirable) in the number of personnel within a typical company to initiate masking within 15 seconds after the functioning of the M8 Alarm or occurrence of other conditions that would require the CAWTS to be activated.

2.1.2.3 Rationale: Under European conditions, a company front could extend up to 1500 meters. The current warning system is ineffective over an area this large.

2.1.2.4 Source: Letter Requirement (LR) for the Chemical Attack Warning Transmission System (CAWTS), approved 8 Jan 79.

*2.1.3 Issue: Does a properly activated cartridge produce audible and visual signals at a minimum height of 500 feet (152.4 meters)?

2.1.3.1 Scope: Testing will be accomplished in an open area and with instrumentation to determine the height at which the cartridge functions.

2.1.3.2 Criterion: When launched vertically, the cartridge shall have the capability of producing audible and visual signals at a minimum altitude above the launch site of 152.4 meters (500 ft).

2.1.3.3 Rationale: Audible and visual signals produced at a minimum altitude of 500 feet have a .91 probability of being in line-of-sight/hearing of personnel located within a 1500-meter radius (company-size area) for terrain similar to that in West Germany.

2.1.3.4 Source: Letter Requirement (LR) for the Chemcial Attack Warning Transmission System (CAWTS), approved 8 Jan 79.

*2.1.4 Issue: Does the audible/visual signal meet the criterion for intensity and duration?

2.1.4.1 Scope: Testing will be conducted with instrumentation to measure the duration and intensity of both the visual and audible alarms.

2.1.4.2 Criteria: The duration of the audible alarm shall be at least five seconds and have an intensity of 125-168 db (0.5 meters from the source). The duration of the visual signal shall be least five seconds and have an intensity of 25,000 to 50,000 candlepower.

2.1.4.3 Rationale: The noise and confusion on a battlefield will require that the visual/audible signals be of sufficient duration and intensity to get the attention of the majority of the personnel in the unit regardless of the distractions being encountered.

2.1.4.4 Source: Letter Requirement (LR) for the Chemical Attack Warning Transmission (CAWTS), approved 8 Jan 79.

2.1.5 Issue: Does the CAWTS cartridge meet the size and weight limitations specified in the LR?

2.1.5.1 Scope: A random sample of sufficient size to give statistically significant data will be selected from the DT test items. The items will be weighed and measured to determine if the criterion have been met.

2.1.5.2 Criterion: The cartridge shall not exceed the following size and weight limitations: length - 30.5 cm/12 inches, diameter - 40mm/1.58 inches, weight 681 grams/1.5 pounds.

2.1.5.3 Rationale: The size and weight of the CAWTS must be kept at a minimum so as not to overburden the operator while carrying them in the field.

2.1.5.4 Source: Letter Requirement (LR) for the Chemical Attack Warning Transmission System (CAWTS), approved 8 Jan 79.

*2.1.6 Issue: Can the CAWTS be easily and safely carried and fired by typical user troops?

2.1.6.1 Scope: Typically trained troops will be required to carry and operate the CAWTS in daylight and darkness.

2.1.6.2 Criterion:

a. The CAWTS will not present a safety hazard to typically trained troops while it is being carried or when it is fired.

b. Troops will be able to readily distinguish, by sight and by touch, between the CAWTS cartridge and similar pyrotechnic signaling cartridges.

c. The CAWTS will be designed in such a manner that two cartridges can easily be carried on the person of the operator.

2.1.6.3 Rationale: Ease of use and safety must be considered for any new item of equipment. To mistakenly utilize the CAWTS for another pyrotechnic signaling device would result in false alarms, causing the troops to needlessly go into chemical protective posture and thus reducing the troops' confidence in the device.

2.1.6.4 Source: Letter Requirement (LR) for the Chemical Attack Warning Transmission System (CAWTS), approved 8 Jan 79.

2.1.7 Issue: Does a properly employed CAWTS create a fire hazard when utilized in areas where fires could be started?

2.1.7.1 Scope: Testing will be accomplished by firing the CAWTS in wooded, brushy, grassy, and urban areas to determine if falling debris from the activated CAWTS retains enough heat to start fires.

2.1.7.2 Criterion: Falling debris from activated CAWTS cartridges will not start fires in wooded, grassy, or urban terrain.

2.1.7.3 Rationale: The CAWTS must be utilized extensively during training exercises in order to train user troops to recognize and respond properly to it. The system must be safe to utilize in any type of terrain to prevent injury and property damage from fires.

2.1.7.4 Source: Message 101457Z Sep 79, HQ TRADOC, ATCD-Z, subject: Special In-process Review (IEP) for the XM207 Ground Signal.

2.2 Survivability/Vulnerability.

*2.2.1 Issue: Is the cartridge designed to withstand absorption of liquid chemical agents?

2.2.1.1 Scope: CAWTS cartridges will be contaminated with liquid chemical agents to determine the ability of the material to withstand absorption of agent and to determine ease of decontamination.

2.2.1.2 Criterion: The cartridge shall withstand absorption of liquid chemical agents to minimize decontamination efforts.

2.2.1.3 Rationale: Cartridges that become contaminated with liquid chemical agents must be easily and quickly decontaminated in order for the troops to continue to carry/use them. Cartridges that cannot be decontaminated must be destroyed and new ones requisitioned, placing an unnecessary burden on the logistical system.

2.2.1.4 Source: Letter Requirement (LR) for the Chemical Attack Warning Transmission System (CAWTS), approved 8 Jan 79.

2.3 Reliability.

*2.3.1 Issue: Does the system possess sufficient reliability?

2.3.1.1 Scope: The CAWTS will be tested under simulated combat conditions expected in central Europe. Additionally, the items will be stored under climatic categories 1-7 (AR 70-38).

2.3.1.2 Criterion: The minimum acceptable value (MAV) for the system reliability is .90. The best operational capability (BOC) is .95.

2.3.1.3 Rationale: The basic load of CAWTS will be limited in number. The field soldier cannot be burdened with carrying an excessive number of cartridges; therefore, a minimum of 90 percent of the cartridges must fire correctly when activated.

2.3.1.4 Source: Letter Requirement (LR) for the Chemical Attack Warning Transmission System (CAWTS), approved 8 Jan 79.

2.4 Training:

2.4.1 Issue: Is the draft technical documentation adequate?

2.4.1.1 Scope: This issue addresses the draft technical manuals provided as a result of Skill Performance Aids (SPAS) Development. The document will be analyzed to insure that the information provided is accurate, the level of detail is sufficient for inexperienced personnel to use, is fully proceduralized, organized in such a manner that illustrations are facing the text, and procedures are efficient. This evaluation is conducted by observing test players performing tactical operations.

2.4.1.2 Criterion: All of the test players will be able to correctly employ the CAWTS after reading any technical documentation or other written instructions provided on the use and firing of the cartridge.

2.4.1.3 Rationale: Manuals must be written in such a manner that average trained troops can read them and gain an understanding of how to operate and/or maintain the CAWTS.

2.4.1.4 Source: Appendix T. TRADOC Regulation 71-9, dated 1 Oct 78.

3.0 CONCEPT OF EVALUATION: All information pertinent to evaluation of operational issues will be derived from Development Test II (DT II) and Operational Test II (OT II). The data source matrix listed in paragraph 4.0 describes whether DT II or OT II is the primary or secondary data source for each issue. The analysis of data will be by objective methods whenever possible. Certain issues will require subjective analysis.

4.0 DATA SOURCE MATRIX. See Annex A.

5.0 MILESTONES. See Annex B.

6.0 COMMENTS AND CONCURRENCE. See Annex C.

ANNEX A - DATA SOURCE MATRIX

ISSUES	DT II	OT II
2.1 MISSION PERFORMANCE		
2.1.1 Can the cartridge be safely hand-launched?	P	P
2.1.2 Does the CAWTS fulfill its warning function?		
a. Max signal occur within seven seconds?	P	S
b. Warning radius extend to 500 meters (minimum acceptable, 1500 meters desirable)?	P	P
c. Cause a twofold increase (minimum acceptable, 95 percent of personnel desirable) in personnel who initiate masking within 15 seconds?	-	P
2.1.3 Signal produced at minimum height of 500 feet.	P	-
2.1.4 Signals meet criterion for intensity and duration.	P	-
2.1.5 Cartridge meet size and weight requirements.	P	-
2.1.6 Easily and safely carried and fired.		
a. Not present a safety hazard.	P	P
b. Distinguish cartridge from other signaling cartridges.	S	P
c. Two cartridges carried by operator.	S	P
2.1.7 Falling debris will not start fires.	P	P
2.2 SURVIVABILITY/VULNERABILITY.		
2.2.1 Cartridge designed to withstand absorption of liquid chemical agent	P	-
2.3 RELIABILITY.		
2.3.1 Does the system possess sufficient reliability.	P	P
2.4 TRAINING		
2.4.1 Is the draft technical documentation adequate.	P	P

P = Primary data source
S = Secondary data source

ANNEX B - MAJOR MILESTONES

a.	IEP - TRADOC receive from USAOCCS	T-360
b.	IEP - TRADOC approve	T-330
c.	IEP - USAIB receive approved IEP	T-300
d.	OTP - USAOCCS provide scope to USAIB	T-240
e.	OTP - TRADOC receive from USAIB	T-200
f.	NET TSP - USAIB receive from CSL	T-180
g.	Combat/Training Developer TSP - USAOCCS provide to USAIB	T-180
h.	TDP - USAIB submit draft to USAOCCS for coordination	T-90
i.	TDP - USAIB submit to TRADOC for approval	T-60
j.	TDP - TRADOC approval	T-30
k.	Safety release - USAIB receive from CSL	T-30
l.	Operational Test Readiness Statement - USAIB receive from CSL	T-30
m.	Test items received from CSL	T-30
n.	Operational Test Readiness Statement - USAIB receive from USAOCCS	T-1
o.	OT II begin	T-date - 2Q FY 81
p.	OT II complete	T+30
q.	OT II Test Report - USAOCCS receives from USAIB	T+90
r.	IER - TRADOC receives from USAOCCS	T+150
s.	DEVA IPR	T+180

ANNEX C - COMMENTS AND CONCURRENCES

1. The following agencies did not respond to the USAOCCS request for comments on the Draft IEP for OT II Chemical Attack Warning Transmission System (CAWTS):

a. USA TECOM (US Army TRADOC LO)

b. USA ARRADCOM (DRDAR-PM)

c. USA TRADOC (ATCD-T, ATCD-C, ATCD-AM)

d. USA Signal School (ATSN-CD-TE)

e. USA Field Artillery School (ATSF-CTD-F)

2. The following agencies concurred with the Draft IEP without comment:

a. USA TRASANA (ATAA-CD)

b. USA Quartermaster School (ATSM-CTD)

c. USA Transportation School (ATTSC-CD-TE)

d. USA Logistics Center (ATCL-FT)

e. USA Military Police School (ATSJ-CTD)

f. USA Administration Center (ATZI-PI)

g. USA TRADOC (ATCD-S, ATCD-Z)

h. USA Infantry School (ATSH-CD)

i. USA Engineer School (ATSE-CTD)

3. This HQ concurred in total with all but one comment provided by the US Army Infantry Board and appropriate changes were made to the IEP. The comment nonconcurred with and USAOCCS reason for nonconcurrence was as follows:

Comment: Mission performance, paragraph 3.1. "Change to read *** in an open area and in urban terrain with *** ".

Nonconcur: This is a DT type of test and the projectile must be physically propelled to a minimum height of 500 feet. The type of terrain from which it is fired (as long as the projectile does not strike an overhead obstruction) will have no bearing on the ability of the cartridge to propell itself to that height.

4. Total number of comments received: 38.
Total number USAOCCS concurs with: 23.
Total number USAOCCS nonconcurs with: 15.

5. The agencies listed below provide comments with which USAOCCS nonconcurs or concurs only in part. The comments and USAOCCS reason for non/partial concurrence for each agency follow:

a. USA Combined Arms Center & Ft Leavenworth (ATZLCA-COG)

(1) Comment: Page 1, para 1.4, "Delete: It will not be fired in response ... ".

Nonconcur: If units adjacent to the unit detecting a chemical attack fire their CAWTS, the units adjacent to them could fire their CAWTS and a "ripple effect" could put the entire division into masks.

(2) Comment: Page 2, para 1.2, "Recommend that the time of launch for the CAWTS cartridge be increased."

Nonconcur: The combat developer is confident that this time can be met. The M8 Alarm operator will be required to be constantly cognizant of the alarm and to have a CAWTS immediately available. The M8 Alarm operator would, upon activation of the alarm, immediately fire the CAWTS and then don his protective mask. In a normal combat situation, the M43 Chemical Agent Detector will be placed well upwind of a unit's position. The M8 Alarm will be remoted back into the unit's position; therefore, the M8 Alarm operator will have sufficient time to fire the CAWTS before he masks without increasing the risk of becoming a casualty. However, if the operator masks prior to firing the CAWTS the agent cloud could (depending on wind speed) reach the unit's position and inflict casualties before unit personnel are warned.

(3) Comment: Page 2, para 1.2. "This paragraph implies that since troops are wearing full-protection ensemble, there is an immediate threat of chemical attack. However, if there is no threat then there is no protection requirement. If the latter is the case, the troops will have to mask first, then fire the CAWTS cartridge. This procedure would increase the time of launch for the CAWTS to 18 seconds after the functioning of the M-8 alarm. This timing breaks out to 15 seconds for personnel to mask and put on their hoods and 3 seconds to activate the CAWTS. If the latter is not the case, why is the operator wearing his protective mask and the unit troops (1.3 Rationale) not wearing their masks?"

Nonconcur: It is a known fact that wearing a full chemical protective ensemble will hinder, slow down, and reduce the efficiency of any soldier. The criteria at this paragraph is a "worst case" situation. It is assumed that if the operator can function the CAWTS in three seconds while dressed in full chemical protective ensemble, he can also function the CAWTS in three seconds when not so dressed.

(4) Comment: Page 2, para 1.3. Delete: "This breaks out to 3 seconds ... their hoods." Change to read: This breaks out to 15 seconds for personnel to mask and put on their hoods, 3 seconds to function the CAWTS, 7 seconds for CAWTS to reach its maximum intensity, 5 seconds for sound to travel to all unit personnel, and 15 seconds for unit personnel to mask and put on their hoods.

Nonconcur: See nonconcurrence for comment a(2) above.

(5) Comment: Page 3, para's 3.0 - 3.3. The figure of 500 feet seems to be somewhat high when considering a company under HE and chemical artillery fire.

Nonconcur: FM 21-40 requires automasking masking procedures to be followed under any artillery attack.

(6) Comment: Page 6, para 8.0 Delete: "Can two cartridges easily be carried the individual soldier?" Change to read: Can two cartridges and firing device be carried by the individual soldier/operator?

Nonconcur: The CAWTS requires no firing device. See para 1.3, Characteristics and Configuration.

b. USA Materiel Systems Analysis Activity (DRXSY-T)

(1) Comment: Page 2, para 1.1, add: Times will be measured for troops wearing only the overgarment to mask and function the CAWTS.

Nonconcur: The CAWTS operator will fire the CAWTS prior to masking - see nonconcurrence para a(2) above.

(2) Comment: Page 2, para 1.2, add: Troops must be capable of masking and launching the CAWTS within 12 seconds (9 seconds for masking plus 3 seconds to function the CAWTS) after functioning of the M8 Alarm.

Nonconcur: See comment b(1) above and comment a(2) above.

(3) Comment: Page 2, para 1.3, add: Current doctrine requires masking prior to giving the alarm, therefore, if troops are unmasked, masking must occur prior to functioning CAWTS.

Nonconcur: This criteria is currently for test only. Positive test results may result in a change in doctrine.

c. USA Armor Center (ARZK-CD-TE)

(1) Comment: Recommend IEP address issue of detectability, both aural and visual by tank and infantry troops riding their respective vehicles buttoned-up.

Nonconcur: Tank and mechanized infantry troops riding in a "buttoned-up" configuration would normally utilize the radio net to pass an NBC warning. To utilize a CAWTS in this situation would cause a soldier to open a hatch to fire CAWTS through. This would cause an unacceptable delay in warning the troops involved.

(2) Comment: Due to the visual effect of the proposed CAWTS, the issue of detectability by the enemy becomes important. The visual signal would seem to provide a signature as to that unit's exact location. This would obviously allow a more accurate adjustment of enemy fires on that specific unit.

Concur in part: The proponent accepts this problem as a "known" or a "given." It is obvious that enemy observers will be able to locate US unit positions by initiating chemical attacks, causing the US units to fire CAWTS. However, the casualty producing potential of chemical agents far exceeds that of conventional artillery. If a chemical attack warning is delayed for fear of giving away a position the casualties caused by the chemical attack may well surpass the number caused by subsequent attacks on the "known" position.

d. USA Operational Test Evaluation Agency (CSTE-PON)

Comment: Draft omits information recommended by AR 71-3, User Testing. At a minimum, proposed evaluation procedures and the operational test concept should be added to the IEP. The evaluation procedures should outline major independent and dependent variables and comparisons to be made for each issue. The test concept should outline test conditions (scope, tactical context, levels of independent variables, and sample sizes), data requirements, and data presentation. These elements are necessary to determine whether the issues are testable and whether testing is adequate.

Nonconcur: The CAWTS is a category 4 system; therefore, in accordance with Appendix E, para E-3 of TRADOC Reg 71-9, a summary statement of proposed evaluation procedures is all that is required. The requested information is developed in the Test Design Plan.

e. USA Air Defense School (ATSA-CD-MS-W)

(1) Comment: Para 2.2, Change: add the following paragraphs under "2.2 Survivability/Vulnerability".

*2.0 Issue: Can enemy forward observers accurately adjust artillery fire onto US battle positions after observing a CAWTS being fired?

2.1 Scope: Forward observers will observe CAWTS firings from varying ranges and under bright daylight and clear night weather conditions (the worst case for enemy observation of US positions) to determine (1) the range at which a CAWTS can be observed and (2) the corresponding accuracy with which the observers can mark the site of the CAWTS firing and thereby simulate the adjustment of artillery fire.

2.2 Criterion: The CAWTS will not provide a source of accurate artillery adjustment to a forward observer beyond the maximum effective range of US direct fire weapons.

2.3 Rationale: CAWTS must be used sufficiently close to friendly troops so that it can effectively warn a platoon or company on an extended front. Accurate adjustment of enemy artillery fire onto the site of a CAWTS firing may cause an unacceptable loss to US forces. At the effective range of Direct Fire Weapons, it is assumed that US forces will voluntarily disclose their positions by engaging forward enemy elements.

(2) Comment:

*3.0 Issue: Can enemy ground and aerial observers determine the location of the FEBA and/or forward battle positions by observing multiple CAWTS firings under a widespread chemical attack.

3.1 Scope: Ground and aerial observers with infrared devices will observe multiple CAWTS firings from varying ranges and under bright daylight and clear night weather conditions (the worst case for enemy observation of US positions) to determine the accuracy with which a simulated FEBA and forward positions can be located.

3.2 Criterion: The CAWTS will not reveal a trace of the FEBA nor the location of forward positions to an observer beyond the maximum effective range of US direct fire weapons or US Short Range Air Defenses.

3.3 Rationale: CAWTS will be issued at the company or platoon level. The enemy's ability to detect CAWTS firings under a widespread chemical attack can reveal troop disposition, the location of the FEBA, and other forward positions.

Reason: The advantage of effective and timely warning of chemical attack must be carefully weighed against the possible disadvantages inherent in our disclosure of our position to the enemy. Should the enemy be knowledgeable of our CAWTS, he may attempt to exploit this in two ways. Strategically, the enemy may observe the disposition of US forces, the trace of the FEBA and the location of forward positions, during a widespread chemical attack. Tactically, the enemy may employ a chemical attack in conjunction with his main assault and attempt to accurately adjust his indirect fire by observing CAWTS firings.

Nonconcur: See Concur in part for comment c(2) above.